

## INTRODUCTION

The Great Lakes Environmental and Molecular Sciences (GLEAMS) Center, funded by the Environmental Protection Agency (EPA), addresses the effects of urban, industrial, agricultural and other non-point source pollution on the Great Lakes through investigations conducted on multiple spatial and temporal scales. The Center was established as a collaborative venture between Western Michigan University's Environmental Institute and the Michigan Tech Research Institute (MTRI). GLEAMS focuses on the Kalamazoo River watershed in Michigan as the primary watershed of interest, which is an EPA designated Superfund site due to high concentrations of Polychlorinated Biphenyls (PCBs) in this watershed. The Center has created a unique interdisciplinary web-based portal to address the Kalamazoo watershed. The Portal provides a one-stop-shop for the Kalamazoo Superfund site, by facilitating public access to environmental data, enabling collaboration among stakeholders, highlighting new scientific developments for ecosystem health characterization, and providing simplified interfaces for complex scientific models. GLEAMS has expanded to include PCB and mercury modeling for the lower Fox River, Wisconsin.

## PORTAL CHARACTERISTICS

A unique interdisciplinary web-based portal has been created for the Kalamazoo watershed, which integrates environmental chemistry, molecular biology, remote sensing, and geospatial information technology. The GLEAMS Portal has dynamic, automated updates, and uses baseline data sets, including bathymetry, river discharge rates, bottom type, contaminant levels, and flora and fauna species. The Portal also has appropriate models available for the river, including river hydrodynamics, fate and transport, food web relationships, chemical contaminant to gene expression and appropriate health advisories.

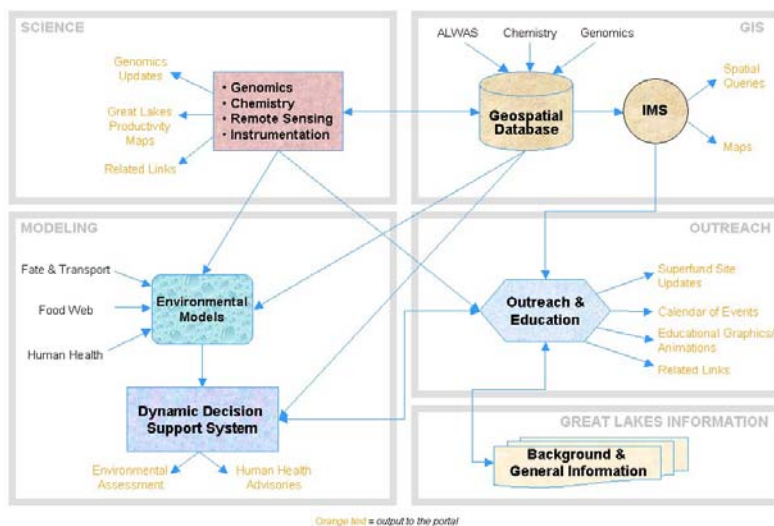


Figure 1. Conceptual diagram of the five Components of the GLEAMS portal.

The Portal contains all relevant baseline data sets for the Kalamazoo River watershed, including bathymetry, river discharge rates, bottom type, sediment and water chemistry, genomic sampling, census data, climate data, EPA designated contaminated sites, flora and fauna species distributions, public health statistics, infrastructure, geology, topography, and aerial photography.

## DYNAMIC DECISION SUPPORT SYSTEM

The GLEAMS Portal features a web-accessible GIS, which is implemented using customized HTML/Javascript web pages and a web service that accesses GIS data using ESRI's Internet Map Server (IMS) software. A major customization to the standard IMS toolbar was the addition of two tools: 1) a tool for making ecological and human health risk assessments, and 2) a tool for calculating an index of water quality.



## RISK ASSESSMENT TOOL

The Risk Assessment Tool calculates appropriate risk and hazard quotients to ecological and human receptors based on standard EPA models that have been implemented for the Kalamazoo River watershed. While risk assessment reports typically assess risk for a limited number of target user groups and for a limited number of contaminated regions, the risk tool allows the user to select a specific location within the watershed and enter specific consumer characteristics to allow for a more accurate assessment of risk. The consumer characteristics that can be specified include: body weight, age, gender, and fish consumption habits.

Based on the estimated PCB contamination for the location specified by the user and the entered consumer characteristics, the risk tool produces a color-coded assessment of risk for cancer, immunological health, and reproductive health (see Figure 2). The risk assessment page also includes links that describe the implemented EPA equations and intermediate calculations.

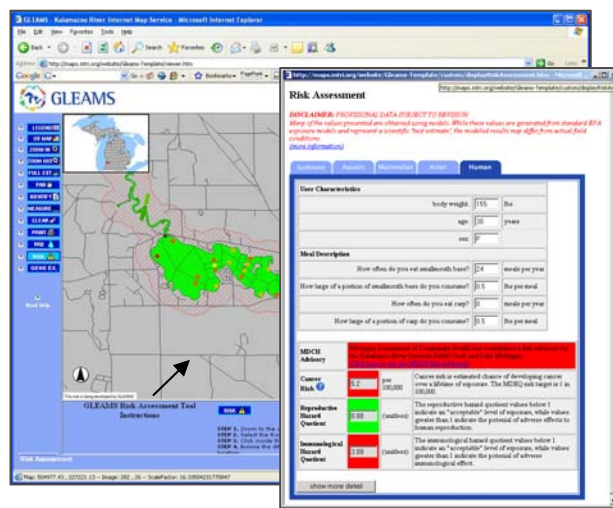


Figure 2: Human health risk assessment calculations based on user-supplied characteristics. Green outlines designate 'acceptable' risk, while red outlines designate 'unacceptable' risk for cancer, reproductive health, or immunological health.

The risk tool also assesses ecological risk for many aquatic, mammalian, and avian receptors that live in the Kalamazoo Watershed. Although not shown in Figure 2, the ecological assessments are accessed for the same location by selecting the appropriate tab to the left of the 'Human' risk assessment tab.

## WATER QUALITY INDEX (WQI) TOOL

The Water Quality Index (WQI) Tool calculates an index of water quality for a particular use. The Index is single value that summarizes many different water quality parameters. Mathematically, the Index is an arithmetic weighting of normalized water quality measurements.

The normalizations, as well as the weightings, are varied for different water usages. The National Sanitation Foundation (NSF) uses a WQI based on nine water quality parameters to monitor the quality changes in a particular water supply over time (NSF, 2006). The WQI Tool in the GLEAMS DDSS is based on physical and chemical measurements obtained from the ALWAS sensor platform, a free-floating data collection system that has been deployed in the Kalamazoo River (see Figure 3).

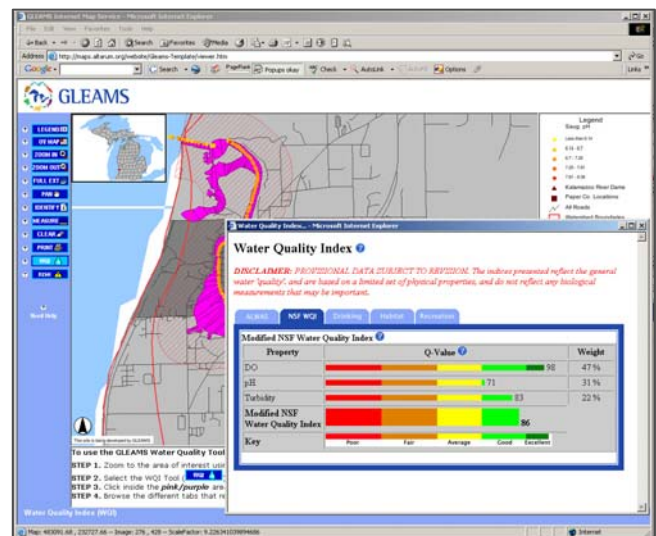


Figure 3: A Water Quality Index (WQI) calculated for a location in the Kalamazoo River. Water quality parameters are normalized to a score between 0 and 100, combined using predefined weights to calculate an Index for a general 'usage type.'

### Reference

National Sanitation Foundation (NSF), Water Quality Index, [http://www.nsf.org/consumer/just\\_for\\_kids/wqi.asp](http://www.nsf.org/consumer/just_for_kids/wqi.asp), accessed 11/8/2006.

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